Methods for Efficient, Reliable, and Reproducible Science

Time: Mondays, periods 3 & 4 (9:35 to 11:30)

Location: Steinmetz hall | Room 1027

Instructors:

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room 2209 Steinmetz Hall	room 2211 Steinmetz Hall

Office hours: Anytime, email to schedule appointment

Audience: early-career scientists from all fields of life sciences
Requirement: personal laptop

Course description

This course is designed to bolster the work of early-career scientists, including first year graduate students, by providing them with guidance to create a precise and personalized pipeline allowing them to efficiently conduct and manage their current or future scientific projects. The course will include several practical workshops on how to use organizational tools (Open Science Framework, Rstudio projects, version control systems, collaborative platforms) to establish a reproducible and transparent workflow, as well as workshops on how to plan and preregister a study (including its sampling design and statistics) to obtain reliable and credible scientific results.

Course learning objectives

By the end of this class, students will be able to:

- **Explain the reasons behind the loss of confidence in science and the replicability crisis across many fields of life sciences**
- **Implement, in their own research, the relevant measures that will increase the credibility of their own scientific process (in the eyes of their peers, funding agencies, and the public)**
- **Effectively integrate practical tools into their workflow that will increase their efficiency and productivity when managing their scientific projects**
- **Critically evaluate the reliability of scientific findings**
- **Effectively communicate core scientific values and become an ambassador of high scientific standards**

Weekly Schedule

	Date	Topic	Pre-class Reading	Assessment	In class activity
1	01.28	**Causes of the replicability crisis**	yes	Pre-class: Worksheet for readings *10pts*	Think-pair-share Lecture
2	02.05	**Preregistration ensures the reliability of results**	yes	Pre-class: Worksheet for readings *10pts*	Lecture - Discussion Structured academic controversy
3	2.11	**Replication**	yes	Pre-class: - Online Canvas Quiz "identify problems and solutions" *20pts* - Submit chosen articles + worksheet for readings 15pts	Mini-lecture Think-pair-share Online searches
4	02.18	**Reproducibility using code and version control (R studio and Git)**		Pre-class: - Discussion post on identifying ease and difficulties to replicate study *10pts* - Submit preregistration or replication hypothesis and predictions *10pts*	Workshop with personal computer
5	02.25	**GitHub**		Pre-class: Submit preregistration protocol *15pts*	Workshop with personal computer
6	03.11	**Simulation of data and data analysis - tutorial**	yes	Pre-class: Worksheet for readings *10 pts*	Workshop with personal computer
7	03.18	**Simulation of data and data analyses - own data**		Pre-class: Submit preregistration confirmatory statistical analysis *20pts*	Workshop with personal computer
8	03.25	**Open Science Framework** as a centralized platform +	yes	Pre-class: Submit chosen articles + worksheet on readings *15 pts*	Workshop with personal computer Structured academic controversy

		Open data, Open code			
9	04.01	**Peer-reviewing preregistration**		Pre-class: - Share the structure of your OSF (with addons) and Github (with read.me file) accounts *10pts* - Submit complete draft of preregistration *15pts* In class: contribution to peer-reviewing preregistration of other students *20pts*	Peer-review preregistration
10	04.08	**Specific tools** (presented by students) + **work on own projects**		In class: Student presentations (7min/student) *20pts*	Student presentations Receive feedback and work on own project
11	04.15	**Specific tools** (presented by students) + **work on own projects**		In class: Student presentations (continued)	Student presentations Receive feedback and work on own project
12	04.22	**Being an ambassador for high scientific standards**		Pre-class: - Submit interview recording *20pts* - Submit revised and complete preregistration *50pts* In class: interview report and contribution to reflections on potential barriers to overcome in order to move the field forward *30pts*	Student presentations Wrap-up discussion

Disclaimer: This schedule represents our current plans and objectives. As we go through the semester, those plans may need to change to enhance the class learning opportunity. Such changes, communicated clearly, are not unusual and should be expected.

Evaluation of Grades

Assignment	Total Points	% Final Grade
Reading worksheets (4)	55	18.3%
Quiz (1)	20	6.7%
Preregistration(1, scaffolded in 5 pieces)	115	38.3%
Oral presentations (2)	50	16.7%
Submissions of content (4)	60	20%
Total	300	100%

Grade and associated percent ranges

A 90.0-100	A- 87.0-89.9	B+ 84.0-86.9
B 81.0-83.9	B- 78.0 - 80.9	C+ 75.0 - 79.9
C 72.0 – 74.9	C- 69.0 - 71.9	D+ 66.0 - 68.9
D 63.0 - 65.9	D- 60.0 - 62.9	E 0 - 59.9

Grade Make-Up Policy

Pre-class assignments (14) are due in Canvas on midnight before the class meeting. Pre-class assignments submitted late will have their maximum grade reduced of 20% per day late. Missed in-class assignments (3) will need to be submitted online, as a pre-class assignment for the next session. Assignments submitted after the last session will not be graded.

More information on UF grading policy may be found at: http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#grades
https://catalog.ufl.edu/ugrad/current/regulations/info/grades.aspx

Relevance of the course for STEM graduate students learning outcomes

This course directly relates to the best practices for graduate education in STEM PhD degrees reported by the National Academy of Sciences "CORE COMPETENCIES FOR THE STEM PH.D. DEGREE: d. Design a research strategy, including relevant quantitative, analytical, or theoretical approaches, to explore components of the problem and begin to address the question. e. Evaluate outcomes of each experiment or study component and select which outcomes to pursue and how to do so through an iterative process. f. Adopt rigorous standards of investigation and acquire mastery of the quantitative, analytical, technical, and technological skills required to conduct successful research in the field of study. g. Learn and apply professional norms and practices of the scientific or engineering enterprise, the ethical responsibilities of scientists and engineers within the profession and in relationship to the rest of society, as well as ethical standards which will lead to principled character and conduct." https://www.nap.edu/resource/25038/Graduate%20STEM%20Education-ReportHighlights.pdf

Attendance Policy

Attendance is critical for success in this course. Excused absences must be consistent with university policies in the Graduate Catalog (http://gradcatalog.ufl.edu/content.php?catoid=10&navoid=2020#attendance) and require appropriate documentation. Additional information can be found here: https://catalog.ufl.edu/ugrad/current/regulations/info/attendance.aspx. If you need to be absent from class, please email the instructors as soon as you are aware (and before the missed class).

Students Requiring Accommodations

Students with disabilities requesting accommodations should first register with the Disability Resource Center (352-392-8565, https://www.dso.ufl.edu/drc) by providing appropriate documentation. Once registered, students will receive an accommodation letter which must be presented to the instructor when requesting accommodation. Students with disabilities should follow this procedure as early as possible in the semester.

Course Evaluation

Students are expected to provide feedback on the quality of instruction in this course by completing online evaluations at https://evaluations.ufl.edu/evals. Evaluations are typically open during the last two or three weeks of the semester, but students will be given specific times when they are open. Summary results of these assessments are available to students at https://evaluations.ufl.edu/results/.

University Honesty Policy

UF students are bound by The Honor Pledge which states, "We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: "On my honor, I have neither given nor received unauthorized aid in doing this assignment." The Honor Code (https://www.dso.ufl.edu/sccr/process/student-conduct-honor-code/) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: http://registrar.ufl.edu/catalog0910/policies/regulationferpa.html

Campus Resources

Health and Wellness

U Matter, We Care:

If you or a friend is in distress, please contact umatter@ufl.edu or 352 392-1575 so that a team member can reach out to the student.

Counseling and Wellness Center: http://www.counseling.ufl.edu/cwc, and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or http://www.police.ufl.edu/.

Academic Resources

E-learning technical suppor*t*, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. https://lss.at.ufl.edu/help.shtml.

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. https://www.crc.ufl.edu/.

Library Support, http://cms.uflib.ufl.edu/ask. Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. https://teachingcenter.ufl.edu/.

Writing Studio, 302 Tigert Hall*,* 846-1138. Help brainstorming, formatting, and writing papers. https://writing.ufl.edu/writing-studio/.

Student Complaints Campus*:* https://www.dso.ufl.edu/documents/UF_Complaints_policy.pdf.

On-Line Students Complaints*:* http://www.distance.ufl.edu/student-complaint-process.